REMARKS

In section 4 of the Office Action, the Examiner objected to claims 21-29 requiring an amendment to claim 21. Accordingly, claim 21 has been amended as suggested by the Examiner to overcome the objection.

In section 6 of the Office Action, the Examiner rejected claims 21, 22, 25, and 28 under 35 U.S.C. §103(a) as being unpatentable over the Litwin patent.

In Figure 1, the Litwin patent discloses a varactor 10 comprising a p-MOS enhancement transistor formed in a p type silicon substrate 11. An n type well 12 is formed in the p-type silicon substrate 11, and a p+ type source region 13 and a p+ type drain region 14 are formed in the n type well 12. An insulating layer 15 is formed over the p type silicon substrate 11, the n type well 12, the p+ type source region 13, and the p+ type drain region 14. A poly-silicon gate 16 is formed on the insulating layer 15 covering at least a part of the n type well 12 such that the gate 16 is electrically insulated from the n type well 12. A first electrode C_A is commonly connected to both the source region 13 and to the drain region 14, and a second electrode C_B is connected to the gate 16.

A varactor 20 is similarly constructed except that the source and drain regions are n+ type and the well is p type.

The gate length L_g (corresponding to the distance between the source and drain regions) is less than 2 microns, and the gate width W_g is less than 20 microns.

Figures 10-13 illustrates a composite varactor 80 having an n type well region 82 formed in a p type substrate 81. A p+ type region 83, 91, 84, 90 having a comb-shaped form is formed in the well region 82. A gate 86 is separated from the substrate 81 and the well region 82 by an insulating layer, and is formed at regions corresponding to the regions between the "fingers" of the comb-shaped p+ type region 83, 91, 84, 90. The gate 86 forms a first electrode of the composite varactor 80, and the p+ type region 83, 91, 84, 90 is connected to a second electrode of the composite varactor 80.

The composite varactor 80 is thus made up of a number of MOS transistors, each having a source region, a drain region, a gate 86, and a channel region formed between the source region and the drain region. These MOS transistors are coupled in parallel to form the composite varactor 80. The composite varactor 80 can be

provided with a high Q factor by using small dimensions of the gate and the channel region and by keeping the resistance of the gate (and its connection) as small as possible. Small dimensions of the gate and the channel region give rise to a varactor having a capacitance with a sometimes unacceptable small numerical value. However, a suitable capacitance can be achieved by coupling a suitable number of varactors in parallel. Composite varactors having high Q factors and suitable capacitances are thereby provided and may be used in high frequency applications.

By contrast, independent claim 21 recites a method that includes the forming of a plurality of alternating P- wells and N+ regions in a silicon layer such that each of the P- wells forms a first N+/P- junction with the N+ region on one side and a second N+/P- junction with the N+ region on the other side. Gate oxides are formed above the P- wells, and silicon gates are formed above the gate oxides. The silicon gates are electrically coupled together, and the N+ regions are electrically coupled together.

As noted by the Examiner, the Litwin patent in Figures 10-13 does not disclose a composite varactor with alternating P- wells and N+ regions, gate oxides formed

above the P- wells, and silicon gates formed above the gate oxides. Accordingly, the Examiner asserts that one of ordinary skill in the art would readily and desirably adapt the composite varactor disclosed in the Litwin patent to use the region types recited in independent claim 21.

However, the Examiner does not suggest any motivation for adapting the composite varactor disclosed in the Litwin patent to have the regions of the types required by independent claim 21 except to argue that Figures 1 and 2 of the Litwin patent suggests that a varactor can be provided with source, drain, and well regions of different conductivity types.

Even if Figures 1 and 2 of the Litwin patent were to suggest that a varactor can be provided with source, drain, and well regions of different conductivity types as argued by the Examiner, the Litwin patent does not disclose source, drain, and well regions having the specific types recited in independent claim 21. Moreover, the Litwin patent does not disclose or suggest anything that would motivate the ordinary artisan to provide a varactor with source, drain, and well regions having the specific types recited in independent claim 21.

Accordingly, because the Litwin patent neither discloses nor suggests a varactor having regions as defined in independent claim 21, independent claim 21 is patentable over the Litwin patent.

Furthermore, when providing a composite varactor, the Litwin patent discloses only the use of regions having conductivity types disclosed in Figure 1 and does not disclose or suggest that the conductivity types disclosed in Figures 2 and 3 could also be used in forming a composite varactor. This lack of disclosure or suggestion would lead the ordinary artisan away from the invention of independent claim 21.

Accordingly, because the Litwin patent would lead the ordinary artisan away from the invention of independent claim 21, independent claim 21 is patentable over the Litwin patent for this reason also.

Because independent claim 21 is patentable over the Litwin patent, dependent claims 22, 25, and 28 are likewise patentable over the Litwin patent.

In section 7 of the Office Action, the Examiner rejected claims 23, 24, 26, 27, and 29 under 35 U.S.C. §103(a) as being unpatentable over the Litwin patent in view of the Chiang patent.

The Chiang patent discloses a thin film polysilicon varactor which has a larger effective gate area in accumulation than in depletion. However, the Chiang patent does not disclose or suggest a varactor with regions having the conductivity types recited in independent claim 21.

Therefore, because neither the Litwin patent nor the Chiang patent discloses or suggests a varactor having regions as defined in independent claim 21, independent claim 21 is patentable over the Litwin patent in view of the Chiang patent. Because independent claim 21 is patentable over the Litwin patent in view of the Chiang patent, dependent claims 22-29 and 31, including dependent claims 23, 24, 26, 27, and 29, are likewise patentable over the Litwin patent in view of the Chiang patent.

CONCLUSION

In view of the above, the claims of the present application are definite and patentably distinguish over the art applied by the Examiner. Accordingly, allowance of these claims and issuance of the present application are respectfully requested.

Respectfully submitted,

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